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Remarks on the Evidence brought forward on the question of a supposed Remarkable Change in the Great Nebula near η Argûs. By William Lassell, Esq.

On the diminution of brightness of η itself, the evidence is uniform and corroborative; showing that it has diminished from about 1·2 in 1837 (Herschel's notation) to about the 6th or even 7th magnitude, which latter it is now (1871) expressly stated to be by Mr. H. C. Russell, Government Astronomer, Sydney, New South Wales.

The first paper I find upon the variation of the Nebula is from Mr. F. Abbott, dated Hobart Town, June 1863, and is contained in the *Monthly Notices*, vol. xxiv. page 4. He therein says,

"The open space, as given in the Cape Monograph, is somewhat in the form of a dumb-bell, compressed in the centre and surrounded with nebulæ, in the most dense part of which is situated η *Argûs*. The appearance of the open space now assumes the form of a crooked billet, wide in the centre and open at both ends, with η *Argûs* situated within the open space, or dark part, and surrounded with an almost innumerable quantity of brilliant stars, many of which are arranged in groups, some being of a blue and some of a ruddy colour. They are remarkably brilliant in the dark space, and afford a good comparison with the variable star itself. . . . In 1838, when examined by Sir John Herschel, the star η *Argûs* was situated in the most dense part of the nebula, and was seen as a star of the first magnitude, and now in 1863 it is out of the nebula, and within the dark space it only appears a star of the sixth magnitude."

Then follows a rude diagram, in which no position with reference to east, west, north, or south, is indicated.

At page 5 Mr. Abbott says,

"That the star's right ascension has not varied so much

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will be manifest. It is clear, then, that the dense portion of the nebula towards the east must have receded, leaving each end open, and η *Argûs*, together with about seventy stars ± up to the 14th magnitude, as seen within the dark space."

In a note is the following :—

"1863, May 23, a drawing made of the object —η *Argûs* quite distinct within the dark space, which is open at both ends."

Again Mr. Abbott states (*Monthly Notices*, vol. xxviii., page 200), in a paper dated Feb. 29th, 1868,

"The principal instrument used is a 5-feet Equatoreal by Dallmeyer . . . and a 5-feet portable refractor by Varley, . . . the eye-pieces in general use . . . are a Comet one of 28, an Orthoscopic of 45 and an Annular Micrometer of about the same power. . . . The beautiful soft white light given out by the nebulous matter about η *Argûs* appears to be produced either from the increased magnitude of the stars or the displacement of some of the nebulous mass, or probably from both, for, in the former case, it is difficult to say (only from its position) which is η *Argûs* and which is not, there being so great a similarity in its size and that of some of the accompanying stars."

In the Cape Monograph only about three stars so large as the 8th magnitude and about six of the 10th magnitude are so near η as a space equal to about half a minute of R.A.; the others are very much smaller, down to the 14th or 15th magnitude. If η, then, was not less than the 6th magnitude, it must have stood out conspicuously among all these; unless it be imagined that while η has been decreasing they have been increasing in something like an equivalent ratio. Again, the import of Mr. Abbott's final remark is scarcely apparent—"If, therefore, the line of sight is brought to correspond with the south of the Cape Monograph, the position of both drawings will be made approximately to agree at the time they were taken."

In another paper by Mr. Abbott (*Monthly Notices*, vol. xxv., page 192, dated Feb. 18, 1865), he says,

"In my former Notes I described the so-called dark space as resembling in shape a clearly defined 'crooked billet;' it now assumes a very different form, and, what is singular, Sir John Herschel describes κ *Crucis* in glowing colours—'like a rich piece of jewellery'—but he is silent as to the colours of the stars round η *Argûs*. In my former Notes I mentioned many of them as being of a ruddy colour, but now they are of decided colours—blue, green, and red, the two former predominating. If the telescope is turned from one object to the other it will be seen that, although Sir John Herschel has not overdrawn the beauty of κ *Crucis*, the object η *Argûs* is now much more superb, η standing out sharp and clear amidst a large field full of richly-coloured gems, with only a very small patch of nebulous matter seen under the telescope."

Mr. E. B. Powell, in a paper dated Madras, 9th March, 1864 (*Monthly Notices*, vol. xxiv., page 170), says,

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"On the 15th April, 1860, I noted in my observation-book that the Nebula was 'much fainter than formerly,' while on the immediately preceding 23rd March the following entry occurs:—'Nebula about η *Argûs* magnificent.' On the date first mentioned η is, in a rough sketch, placed out of the bright portion of the Nebula, and the lemniscate is described as a 'channel.' Several entries follow, noting both the openness of the lemniscate to the south and the greatly diminished brightness of the Nebula. The former fact was acquiesced in by Major Tennant, of the Bengal Engineers, whom I requested to examine the Nebula with the Lerebours Equatoreal of the Madras Observatory. On the 4th April, 1862, the following entry was made in my book:—'η beautifully round and clean, out of the nebulous matter altogether; two patches of nebulous matter, with a passage between them, to the left, or preceding.' "

In a paper of some length, dated Collingwood, 8th June, 1868 (*Monthly Notices*, vol. xxviii., page 225), Sir John Herschel discusses, with abundant care and minuteness, Mr. Abbott's drawing (page 200), selecting several of the principal stars in it near to η, and comparing them, as far as possible, with the stars about η laid down in the Cape Monograph,—but there is really no sort of agreement between them.

On this Sir John remarks,

"What are we then to conclude? Not only the nebulous masses would appear to have drifted far away from their situations in 1835, but the stars of the whole region over an area of nearly two-thirds of a square degree, including stars of the 6th, 7th, and 8th magnitudes, to have also either assumed new configurations *inter se*, or to have bodily fled away and given place to a new set!"

In vol. xxix., page 82, is a paper by Lieut. (now Capt.) Herschel, dated Bangalore, Nov. 23, 1868, giving account of some observations, together with some drawings, of the Nebula made on the 22nd, 23rd, and 24th Nov. 1868. They are accompanied by some remarks of Sir John Herschel, from both of which I make the following extracts. The telescope used was "the Royal Society's 5-inch refractor, power 55 to 200." The drawings are "the appearances under powers of 55 and 125, copied from sketches made on the spot, the originals being retained." "Altitude at the time of observation about 15°, the air clear enough to have shown stars of the 3rd magnitude within a degree of the horizon, roughly speaking."

Of the stars inserted in sketch A, Sir John remarks that twenty of them are unmistakably identified with stars inserted in the Catalogue made by him at the Cape, of stars in the Nebula; and he further says,

"A decisive proof of the absence of any material shifting of position between the lemniscate and η *Argûs* is afforded by the small star [*v*] in a direction pointing from η to about half way between C and D. This star (No. 664 of my Catalogue) oc-

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cupies, both in my engraving and in my son's drawing, precisely the same strongly-marked position, close to the very edge of the most characteristic projection of the Nebula, being just immersed in the Nebula in both."

The *Sydney Morning Herald*, of Saturday, May 13th, 1871, contains an account of a meeting of the Royal Society of New South Wales, at which a long paper was read by Mr. Russell on the Nebula of *η Argûs*. Mr. Russell states that, with the large Melbourne Reflector, after having been repolished by Mr. Le Seur,—"Mr. McGeorge has been able to see that *Eta* is still in the Nebula; and, in his drawing, which includes only the nebulous mass in which the lemniscate is situated, shows the very dense part near and north of *Eta*, the enclosed space, and some remarkable minor details at a point near 17^s preceding and 80″ north of *Eta*, which are changing rapidly."

Mr. Russell goes on to add, "I determined last year to examine this object, believing that when such a subject is under discussion, all who have the means of furnishing information should do so, and because the Sydney Refractor is, in defining and light-gathering power, nearer to the Reflector with which the Cape drawing was made than any which has since been directed to the object. . . . Unfortunately, in August last, *Eta Argûs* was too low down to admit of any satisfactory observations, and I was obliged to defer it to January this year; when I took every favourable opportunity of observing it, and completed the drawing early in March. The observations were taken after the object had attained an altitude of 50° up to 64°. Of the 108 stars in my list, I was able to identify 104 with those in the Cape list; of the remaining four, one, No. 25, is very small, and forms part of a triangle close to *Eta;* in 1834–8 it was probably hidden by the light of *Eta*."

Then, after a discussion upon the possible or probable change in some half-dozen stars, from the 6th to the 7th magnitude, he says,—"I would not, however, lay too much stress upon this until it is known whether all the 7th magnitudes in the Cape list were equal, for, if not, it may be only Nos. 71 and 105 have changed. As to the colours of the stars near *Eta*, they are in my estimation pale indeed compared with *κ Crucis;* and if in 1865 bright enough to merit Mr. Abbott's remark—'that although Sir John Herschel has not overdrawn the beauty of *κ Crucis*, the object *Eta Argûs* is much more superb'—they must have faded wonderfully since; for I only remarked colour in two, besides *Eta*, and both were red. Dr. Wright, who has examined both objects with an 8½-inch Browning reflector, failed to detect anything striking in those near *Eta*."

Mr. Russell then goes on to state that he carefully measured differences in R.A. and declination from *Eta* of fifty-four stars, and laid them down on a sheet of paper to a scale of twice the size of the Cape Monograph, filling in the Nebula from time to time by observations with the telescope. And he then further

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states,—"The drawing was then reduced to its present size with proportional compasses, and afterwards compared with the object, under different states of the atmosphere, with Moon and without Moon, and corrected until it was deemed a faithful representation of it as seen now. . . . Examining it more in detail, it is seen that the mass in which the lemniscate (or dark enclosed space) is situated is in general outline very much the same as it was thirty years since, and in some of its marked features exactly the same; as, for instance, the definite outline beginning at $70^s-240''$, and running still, exactly as Sir John Herschel has described it, amongst some small stars; but round the border of the lemniscate great changes in the relative brightness of the different parts of the outline have taken place, and some slight changes in the outline itself; the greatest being at $17^s-100''$, where one point now occupies the place of two in the Cape drawing," &c.

Mr. Russell further speaks at some length of surprising changes in the "branches" of the Nebula beyond the lemniscate, viz., at $+40^s+600''$; and yet he states, "The star No. 11 (664 H) is just in the edge of the Nebula," precisely where Sir John has put it.

Towards the close of the paper, Mr. Russell says,—

"Taken as a whole, this object must have increased in brightness very much, for it can now be seen in full moonlight; and in 1834–8 it was at all times invisible to the naked eye. This fact, and the great similarity in outline between the Sydney and the Cape drawing, have inclined me to think, that if the same reflector could again be turned to this object the lemniscate would be found very little altered, and the apparent difference quite as much, perhaps more, in the increase of light at two points before indicated, as in the loss of light in other parts."

The copy of the *Sydney Morning Herald* from which the above extracts are made was sent in a letter from Mr. Russell to Collingwood, but arrived after Sir John's lamented decease; and having been favoured with the perusal of it, I have been induced to examine and compare the evidence both ways as to the supposed changes in this remarkable Nebula. My own conclusion, from a careful consideration of the various papers from which the above extracts are made, is, that we must require much more decisive evidence than herein exists, before we can admit that these alleged astounding changes have taken place. It is much to be regretted that Mr. Russell did not accompany his letter by a copy, more or less elaborate, of the drawing and stars he has so carefully laid down. It certainly would have been easy for any very moderately-skilled draughtsman to make one sufficiently accurate for the purpose. And also it is surprising that Mr. Russell should have omitted to give any description of the telescope he used, merely calling it the Sydney Refractor, without any mention of focus, aperture, or powers used. There are some other requirements which ought also to have been supplied before the hypothesis of even the alleged lesser changes can be allowed as

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established. The Nebula, being circumpolar both at Hobart Town and Sydney, would (irrespective of the very great differences of altitude under which it was probably observed) present itself to the observers in every possible variety of position, as to *up or down*, and would I believe *therefore* occasion some differences of estimation of form and relative intensity of the different parts. Further, the variety of instruments used, generally of very inferior power to that of Sir John Herschel, and the general want of precision in most of the observations recorded, diminish greatly their respective weight. Again, the declension of magnitude of η, from nearly the 1st magnitude to the 6th or 7th, would of itself cause the respective brightness of the different parts of the surrounding nebula to be very differently estimated.

Under all these circumstances and conditions of this very conflicting testimony, I incline to the opinion that *no proof has yet been given of any change in the Nebula at all.* And, finally, if the subject be not already exhausted, I would refer to another letter from Capt. Herschel, dated 7th May, 1871, and inserted in the *Monthly Notice*, for June last.

Ray Lodge, Maidenhead,
19th July, 1871.

Theoretical Considerations respecting the Corona: Part II.

By R. A. Proctor, B.A. (Cambridge).

Before entering upon the consideration of the remaining portion of my subject, I propose briefly to discuss some questions which have been raised since the former part was written. I refer in particular to the meteoric theory of the Corona,—that is, the theory that a large proportion of the light of the Corona is due to the existence of countless hosts of meteors in the Sun's neighbourhood. I have mentioned already my belief that I had somewhat exaggerated the share which must be assigned to meteoric systems in accounting for coronal phenomena.* But this admission must

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* In a paper by Prof. C. A. Young, of America, entitled "Note on the Spectrum of the Corona" (one of a series of highly suggestive and valuable contributions to the theory of the subject), he says, "Although I am not able to admit with Mr. Proctor that the whole explanation of the Corona is involved in the presence of such meteoric particles, yet it cannot be doubted that they are very numerous; and any that may come within 250,000 miles of the solar surface must become incandescent, &c." I cannot remember having on any occasion asserted that the whole explanation of the Corona is involved in the existence of meteoric systems near the Sun. I could quote many passages implying that I hold the contrary opinion. I may have written at times about the meteoric explanation as founded on a *vera causa* without discussing other *veræ causæ;* but it is not, therefore, to be inferred that I have doubted the reality of these others. I would notice in particular that I have always believed in the atmospheric nature of a portion of the light seen around the Sun during totality—even at the middle of the totality. In a paper in the *Monthly Notices* for March 1870, I note that the illumination of our atmosphere by the light of the prominences and sierra should result in "a faint diffused light diminishing